A NEW, LARGE CILIATE FROM WARM MINERAL SPRINGS [1]

James B. Lackey
University of Florida

About two miles south of the bridge where U. S. 41 crosses the Myakka River in Sarasota County, a large first magnitude spring emerges from a deep boil. This was formerly called Warm Salt Springs (Ferguson, et. al., 1947) but the present developer of the area seems to have changed its name to Warm Mineral Springs as of June, 1954. The flow is between seven and nine million gallons per day of water which has a constant temperature of 86° F., contains no dissolved oxygen, but does contain 0.162 parts per million of hydrogen sulfide. It also contains about 17,000 parts per million of dissolved solids, the principal components of which are shown in Tables I and II. According to Odum (1953), there are .033 parts per million of inorganic phosphorus in the water, and .050 of total phosphorus.

TABLE I

ANALYSIS OF PARTIAL SOLIDS IN WARM MINERAL SPRINGS
PARTS PER MILLION

	Ferguson, et al	Morgan
Dissolved Solids	17,812.00	17,988.00
Iron	0.12	0.09
Calcium	766.00	596.00
Magnesium	471.00	567.00
Silica (SiO_2)	18.00	23.80
Sodium, Potassium	5,124.00	
Chloride	9,350.00	
Bicarbonate (HCO_3)		167.00
Total Hardness ($CaCO_3$)	3,846.00	

These features are part of an environment which is virtually constant and contains about half as much salt as sea water although not in the same composition. As such, the Springs should have a unique biota, and this is the case. There is a limited number of blue green algae and almost no green algae, except slight growths of *Spirogyra, Vaucheria,* and *Oedogonium.* Amoebeae and flagellates are poorly

[1] Work supported by a grant-in-aid from the National Institutes of Health.

represented, although one species of *Euglena* and several colorless genera of Euglenophyceae occur. Ciliates, however, are abundant and include some unusual fresh water species such as *Condylostoma, Saprodinium,* and *Frontonia.* There are also some distinctly salt water forms such as *Diophrys, Uronychia,* and *Uronema pleuricaudatum.* Then there are ubiquitous forms such as *Cyclidium* and, finally, one or more species of H_2S tolerant types such as *Metopus.* In short, there is an unusual ciliate fauna and it is not surprising that new species should be encountered.

TABLE II

CERTAIN PHYSICO-CHEMICAL CHARACTERISTICS OF WARM MINERAL SPRINGS

Temperature	84°F	± 2°
pH	7.2	± .2
Volatile Solids	17.1%	(600°C for 30 minutes)
Nitrate (NO_3)	0.05	ppm
Dissolved PO_4	0.0016	ppm
Total PO_4	0.0037	ppm
Chemical Oxygen Demand (Dichromate)	813.0	ppm
Dissolved Oxygen	0.0	ppm
H_2S	0.162	ppm
HS	0.078	ppm
Sulfate (SO_4)	1,704.0	ppm

Kahl (1933) established the family Geleiidae and the genus *Geleia* for three new species he found in the sand at Kiel. His organisms were, therefore, marine and belonged to the category of sand dwelling ciliates described also by Faure-Fremiet (1950-1951), Noland (1937), and others. *Geleia* is characterized as elongately stretched, strongly contractile, having a mouth which is a long flat pit, close to the anterior end, and on the left of the broad side. Kahl's largest species, *decolor,* is 600-800μ in length and colorless to pale yellow. The color of his smallest species, *nigriceps,* is not given except for small black granules in the anterior end. It is 200-300μ in length; *fossata* is 300-400μ in length and is brownish yellow. As far as known, there has been no reference in the subsequent literature to any of these species.

Faure-Fremiet added two additional species in 1950 and 1951. His first, *G. orbis,* attains a length of 1700μ, is cylindrical in cross sec-

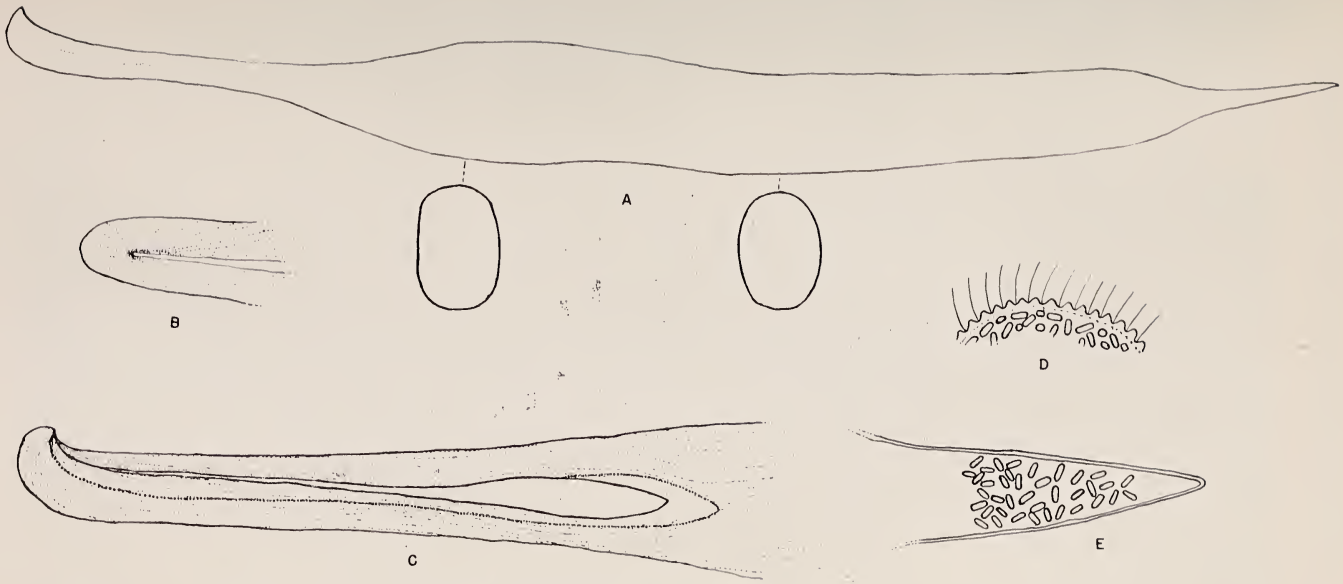

Figure 1. (a) Usual body shape of *Geleia floridensis* sp. nov. Note the two projected cross sections through the body. (b) Ventral view of beak region showing the anterior end of the mouth slit and the ciliation pattern. (c) Mouth slit, its posterior enlargement and the backward internal extension to form a gullet. (d) Optical section to show ridges between the ciliary grooves and the thickness of the pellicle. The peripheral location of the bacteroid-like bodies is indicated. (e) The posterior end, where the bacteroid-like bodies are most easily seen. Illustrations (b) and (c) are approximately three times the magnification of (a), and (d) and (e) are approximately four times the magnification of (a).

tion, and strongly thigmotactic. It is best characterized by very pronounced serpent-like writhings. He reported this one from Europe but also found it at Barnstable on Cape Cod, whence came his second species, *G. simplex.* This one is 206-300μ long and has no anterior prebuccal lobe. Its color is not given.

Among the unidentified ciliates from warm mineral springs is one which at times attained a length of 2 millimeters. Never too abundant, it is sufficiently common for study. It has been determined to be a *Geleia* and the species name, *floridensis,* is proposed for it.

Geleia floridensis n. sp.

The new species, so far found only in Warm Mineral Springs, shown in Figure 1A, is 1400-2000μ in length and is so dark brown in color as to obscure internal details. There is a pointed tail region, which may constitute ⅕ of the length, and a long neck region about ¼ to ⅓ total length. The trunk section of the body is oval in cross section rather than flat but the neck region is distinctly flattened and narrowed. In front there is an overhang, which occasionally is beaked. Beneath this beak or overhang the slit of the mouth begins, 1B, and may extend back about 200μ. Often, at its distal end, it is held open, 1C, as the animal moves around. Underneath the lips a gullet-like sac extends back. The mouth and beak are usually on the right when the organism is seen from above. In this respect it is more like Kahl's *Remanella,* five species of which were described by him in 1933, also from Kiel.

The body is uniformly ciliated, all cilia being short, slender, and 5-10μ long, the longest ones in the beak region and along the mouth slit. They emerge from furrows, 1D, in the thick pellicle. No trichocysts have been demonstrated by crushing or on death. The margin of the mouth is smooth. However, the cytoplasm beneath the pellicle, 1D, E, is filled with short rod-like bodies not arranged in any particular pattern. They are of rather uniform size and resemble bacteroids more than anything else. They persist after the animal is crushed. No other internal structure—nucleus or food vacuole—is evident because of the deep brown color. There are no contractile vacuoles.

The deeper parts of the cytoplasm contain many spherical bodies which appear to be a very light oil because on crushing, they are extruded with the bacteroid-like bodies and persist, not being misci-

ble with water. They do not leave a visible oily stain. The cytoplasm is very slightly brown but along the pellicular ridges are rows of very small but deep brown granules, of irregular size and, within the row, of somewhat irregular elongate distribution. Apparently there are enough of these to help color the organism.

Most of those found have been taken in loose debris or in clumps of algal material, not deep in the sand. The organisms occur in some abundance, moving slowly through the debris, turning and at times contracting to about three fourths of their extended length. In hanging drops, they rarely last more than two days but in jars of Warm Mineral Springs water kept at 80° F. and with algae, *Nitella,* and debris, they have been found for a month after the sample was brought in. When one is crushed, the brown color disappears at once and there are no vestiges of the nucleus to be seen. Crushed animals have been found to contain two or more species of diatom shells, filamentous blue green algal fragments, and *Chroococcus* as well as some amorphous matter. No division stages have been seen.

On the basis of size, relatively constant morphology and color, as well as habitat, it is considered that this is a new species. The contour of the neck region is distinctly different from described species and also from *Remanella.* The species is always dark brown never bright yellow, as is sometimes the case of *G. decolor,* according to Kahl; *decolor* approaches this one in size but it has a wide neck with a rounded caudel end which does, however, termniate in a blunt point. *G. orbis* is nearest in length but is uniformly cylindrical in cross section, is more strongly thigmotactic. *Floridensis* is very deliberate in movement and never given to serpent-like writhings. No "Mullers bodies" have been found and there is no skeletal apparatus as in *Remanella.* The mouth is wholly different from that of *Loxodes.* Altogether the organism appears to be a *Geleia* and a new one.

The group may be characterized as follows:

Family Geleiidae. Kahl 1933.
  Genus Geleia. Kahl 1933.
    Organisms 200-300μ long. No anterior beak. Mouth lateral.
      Black granules in anterior end. *G. nigricans* Kahl 1933.
      No black granules in anterior end. Mouth nearly apical.
        G. simplex Faure-Fremiet 1951.

Organisms 300-400μ long. Beak small. Mouth slit, short. Brownish yellow. *G. fossata* Kahl 1933.

Organisms 600-800μ long. Neck wide, beak poorly defined. Colorless to golden yellow. *G. decolor* Kahl 1933.

Organisms to 1700μ. Serpent-like. *G. orbis* Faure-Fremiet 1950.

Organisms 1400-2000μ long. Neck narrow, beak sharply defined, mouth slit long. Dark brown. *G. floridensis* Lackey 1957.

References

FAURE-FREMIET, E.
1950. "Ecologie des Cilies Psammophiles Littoraux." Bull. Biol. de la France et de la Belgique. 84.
1951. "The Marine Sand-Dwelling Ciliates of Cape Cod." Biol. Bull. 100. No. 1.

FERGUSON, G. E., C. W. LINGHAM, S. K. LOVE, and R. O. VERNON
1947. "Springs of Florida." Geol. Bull. No. 31, Fla. State Dept. of Conservation, Fla. Geol. Survey, Tallahassee.

KAHL, A.
1932. "Die Tierwelt Deutschlands. Ciliata." Gustav Fischer, Jena.

NOLAND, LOWELL E.
1937. "Observations on Marine Ciliates of the Gulf Coast of Florida." Trans. Am. Mic. Soc. 56 (2).

ODUM, HOWARD T.
1953. "Dissolved Phosphorus in Florida Waters." Report of Investigations, No. 9. Fla. State Dept. of Conservation, Fla. Geol. Survey, Tallahassee.

A CORRECTION

A list and bibliography of the mammals of Florida, living and extinct, Sherman, 1952, vol. 15, pages 92 and 93 of this journal lists *Peromyscus gossypinus, Peromyscus floridanus* and *Pitymys pinetorum* as being recorded from the Pleistocene. No literature cited supports these records. They were erroneously and unintentionally included as a result of having information of unpublished manuscript by Mr. H. James Gut, a rare gentleman and a good friend.

H. B. Sherman, DeLand, Florida